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Some years ago, in an address before the Entomological Society of London, Professor Poulton raised the question whether the ability to mate successfully was not after all something maintained by rigid natural selection; and if I remember his argument correctly (I do not possess a copy of his paper), he believed that differences in the sexual organs might be expected to arise whenever selection ceased to operate. Since that time Tower has produced striking evidence of the small amount of divergence which suffices to throw an organism (in his instances beetles) out of the race. In this connection it may also be remarked that the singular fertility between different races of men, dogs, cattle, etc.,—many of these differing exceedingly in many characters of color and form—may be attributed to the effects of natural selection. The purest breeds of dogs, and no doubt the best established races of men, are after all great mongrels; and in the course of time no doubt interracial infertility would be absolutely discriminated against. However active the imagination may be in picturing causes and effects, it can but pause before such cases of genitalic modification as are described by Dr. J. B. Smith in his revision of the moths of the genus Homoptera and its immediate allies, just published by the U. S. National Museum. In some of these moths the sexual organs are extremely asymmetrical. "In the males the asymmetry is between the harpes of the two sides, which in extreme cases are totally dissimilar, with processes on one side for which there is no counterpart on the other, and which are rarely entirely alike. The sheath of the penis or intromittent organ is always more or less curved or bent, or even hooked, and this structure is directly correlated to the differences found in the female." These peculiarities are all figured most carefully.

T. D. A. COCKERELL.

VERTEBRATE PALEONTOLOGY

The Lysorophidæ.—In 1875 Dr. J. C. Winslow, of Danville, Illinois, a local collector of fossils, discovered, at "Horseshoe Bend," on Salt Fork, on the Tate farm, some two miles south of Oakwood, in Vermilion County, Illinois, some bones which he sent to Professor Cope for identification. Later on the work of exploration at this place was taken up by Mr. W. F. E. Gurley and his collection was transferred to the University of

Chicago, where it now is. In 1877 Cope published a description of several forms from among the remains collected at "Horseshoe Bend" among which was the form *Lysorophus tricarinatus,* based on three vertebræ, which Cope took to be of reptilian nature. From the fact that the bones were very similar to some found in the Texas Permian, Cope concluded that the Illinois deposit was likewise Permian; and such it is usually regarded. From the discovery of a similar deposit in Pennsylvania by Raymond[1] it seems more probable that the deposit in Illinois is Pennsylvanian, as is the deposit in Pennsylvania.

In the summer of 1907 Dr. S. W. Williston sent the writer to the Illinois locality for the purpose of settling the stratigraphy, if possible, and to secure more material to illustrate the forms which are so meagerly known. The deposit was found to be already exhausted and after a month's work scarcely a handful of bones was secured. The stratigraphy was almost impossible of determination, though Dr. Stuart Weller, who visited the locality, was of the opinion that the circumstantial evidence was very strong in favor of its being upper Pennsylvanian. Since the discovery of similar deposits in Pennsylvania of undoubted Pennsylvanian age it seems no longer necessary to doubt the Carboniferous age of these Illinois deposits. In 1902 in "Contributions from Walker Museum, Vol. I, p. 45," Case announced the discovery of typical vertebræ of the *Lysorophus tricarinatus* type from the Permian of Texas. Last June Case[2] described the skull of the *Lysorophus tricarinatus* and came to the conclusion that the form was an amphibian. Later in the summer and almost simultaneously papers by Broili[3] and Williston[4] appeared on the same subject. Broili emphatically denied the amphibian nature of Lysorophus and Williston proved conclusively that the form is not only an amphibian, but is even allied to the modern Urodela. Broili reaches the most astonishing conclusion that Lysorophus "erscheint daher nach den in der Systematik geltenden Grundsätzen für richtiger, . . . zu den Lacertiliern zu stellen."

Williston shows very conclusively that the form is an undoubted amphibian and gives the following characters to support his views: skull pointed with no evidence of orbits, paired epiotics present, supraoccipital unpaired, condyle unossified, *branchial apparatus well developed,* vertebral column slender, limbs apparently absent, ribs long, somewhat curved and flat, neurocentral. Williston concludes:

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[1] *Science,* N. S., Vol. XXVI, No. 676.

[2] *Bull. Amer. Mus. Nat. Hist.,* Vol. XXIV, p. 531.

[3] Broili, *Anat. Anz.,* Bd. XXXIII, No. 11/12.

[4] Williston, *Biol. Bull.,* Vol. XV, No. 5.

> "The only aberrant character to distinguish Lysorophus from the Urodela is the long and rather broad ribs, unknown among these modern animals or their possible ancestors, the Branchiosauria. It is, however, very evident that the earliest ancestors of both these groups must have long ribs, and their persistence in Lysorophus would be nothing remarkable."

But why need we conclude that the early ancestors of the Amphibia must have had long ribs? There is no geological evidence of such, and the oldest known branchiosaurian, *Micrerpeton caudatum* Moodie from the middle Pennsylvanian certainly possesses very short ribs. The animals associated in the Carboniferous with the Branchiosauria, as a rule, possess long ribs, but do we need to infer that the Branchiosauria and the Microsauria had the same ancestry?

In all the long stretch of geological time there has never existed a branchiosaurian nor a true urodele which had long ribs, and so far, aside from the frogs found in the Tertiary, these are the only true amphibians known in the fossil state. It is exceedingly incongruous to class the Microsauria and Branchiosauria in the same order Stegocephala. Their organization is totally different. To be sure, the long ribs in Lysorophus might have developed secondarily as Williston suggests, but why do we need to assume even this when among the modern Gymnophiona we find long ribs and every other character which is present in the Lysorophus? It is also possible that the Gymnophiona are true Caudata, in which case there would be no distinction and it may be that Lysorophus will be of great assistance in bridging over this gap between the Caudata and the Gymnophiona.

Certain it is that the form is a most interesting discovery and one of the most important in the phylogeny of the extinct Amphibia in many years. I quote herewith from a letter to Dr. Williston from Dr. Broom which the former was so kind as to send me during the course of our correspondence on the subject:

> "The skull (of Lysorophus) is to my mind undoubtedly Urodele and singularly like that of Amphiuma which I believe to be the nearest living ally. I am convinced that it is not a Gymnophionid . . ."

Here are then three various points of view offered for study—one, of Broili, that the form is a lacertian; two, that of Williston and Broom, that the form is a member of the true Caudata; three, the suggestion offered here that the form may be one of the Gymnophiona. In further support of the view of the gymnophionid character of the form is the snake-like character assumed by *Lysorophus*. Case has noted that the vertebral column is usually coiled where there is any considerable portion of it preserved and Dr. Williston remarked to the writer of the same fact which he had observed in the field while in Texas the past summer. The palate structure of the *Lysorophus* is against the idea of the form being a member of the Gymnophiona, at least so far as we know the palate; further knowledge of this structure will undoubtedly solve the problem.

Further study of the form will also reveal other facts as to its anatomy and we are hoping to hear much from the recent collections of Drs. Williston and Case from the Texas Permian.

Stegocephala.—In an endeavor to reach some definite conclusions in regard to the correct classification of the extinct Amphibia, investigators all over the world are issuing contributions on various phases of the subject. One of the more recent advances is a study of the vertebræ of the Carboniferous forms by Hugo Schwarz,[1] of Griefswald, Germany. He has studied the exact characters of the vertebræ of forms from the coal mines of Linton, Ohio, of which there are specimens preserved in Berlin and in Griefswald, and also specimens from Nürschan bei Pilsen. The work was done under the advice of Dr. Otto Jaekel and the paper shows a strong bias of Jaekel's views.

The methods of study adopted by Schwarz are the same as those proposed by Jaekel five years ago. The specimen is removed from the soft coal, in which it is imbedded, by chemicals and by mechanical means and an impression is made of the mold by wax, plaster or guttapercha. While most of Jaekel's results show that the methods have some advantages, yet it is to be doubted if they are the best in all cases. The interpretation of the material is a puzzle at the best, and when the elements are disturbed it is often very difficult to form any idea of their nature. Jaekel experienced this especially in his discovery of the "perisquamosal" in Diceratosaurus, a structure which does not exist in other species of this genus and was probably due

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[1] *Beiträge zur Paleon. und Geol., Oesterreich-ungarns,* Bd. XXI.